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Date: 16 June 2008

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant : Robert R. Rice
Serial No. : 10/729,261
Filed : 05 December 2003
For : MULTIMODE RAMAN FIBER DEVICE WITH
MODE DISCRIMINATION
Group Art Unit : 2828
Examiner : Tod Thomas Van Roy
Attorney Docket No. : NG(ST)7621

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REPLY BRIEF

Sir:

This Reply Brief is in response to the Examiner's Answer dated April 16, 2008. This Reply Brief addresses the Examiner's Answer concerning the appealed claims 1-17.

I. Appealed Claims 1-5, 12, and 13

With regard to claim 1, in the Appeal Brief filed January 11, 2008 ("Appeal Brief"), Representative for Appellant argued that, in contrast to the Examiner's assertion, the disclosure of a Raman gain coefficient G_R/A_{eff} of $0.005 \text{ (W}^*\text{m)}^{-1}$ by U.S. Publication No. 2002/0135866 to Sasaoka et al. ("Sasaoka") is insufficient to demonstrate a teaching or suggestion of light that is launched into an end of the fiber being subject to higher Raman gain along the optical axis, which promotes lower order modes and discriminates against higher order modes, as recited in claim 1. Examiner responded to Representative for Appellant's arguments in the Examiner's Answer dated April 16, 2008 ("Examiner's Answer"), by stating the following:

As the cross section of the fiber shown in fig. 1a is described in fig. 1b, it is obvious that the refractive index, and thus the dopant profile, is radially dependent. If the GeO₂ were not radially dependent, the parabolic trend seen in the refractive index profile of the core in fig. 1b would not exist, and would in fact have a linear shape. (Examiner's Answer, page 8).

Representative for Appellant respectfully disagrees and respectfully submits that the Examiner has provided no support for such statement. Specifically, Sasaoka does not describe a radially dependent doping, and the Examiner provides no evidence or support for the statement that Sasaoka must have a radially dependent doping profile to achieve the parabolic, non-linear refractive index profile. Representative for Appellant further respectfully submits that, even assuming *arguendo* that such a conclusion regarding the doping profile can be drawn, it is improper for the Examiner to thus conclude that Sasaoka demonstrates a Raman gain coefficient profile that is also radially dependent, such as to promote lower order modes and discriminate against higher order modes, as recited in claim 1. Specifically, the Examiner likewise provides no basis or support for a Raman gain coefficient profile being equivalent in shape to a refractive index profile for a single mode fiber (as disclosed by Sasaoka), particularly based on the disclosure of the effective area-dependent Raman gain coefficient G_R/A_{eff} of $0.005 \text{ (W}^*\text{m)}^{-1}$ by Sasaoka (see below).

Also with regard to claim 1, the Examiner further states that the disclosure of the effective area-dependent Raman gain coefficient G_R/A_{eff} of $0.005 \text{ (W}^*\text{m)}^{-1}$ by Sasaoka is only a

minimum value, and that it does not mean that the value is uniform across the diameter of the fiber (Examiner's Answer, page 9). Representative for Appellant respectfully submits that Sasaoka discloses that the "Raman amplification optical fiber 100 has a Raman gain coefficient G_R/A_{eff} of $0.005 \text{ (W}^*\text{m)}^{-1}$ or more," (Sasaoka, paragraph 26). Therefore, Sasaoka discloses that the Raman gain coefficient G_R/A_{eff} is applicable to the optical fiber as a whole, and not to cross-sectional portions of it. Therefore, Representative for Appellant respectfully submits that Sasaoka discloses that the Raman gain coefficient G_R/A_{eff} is uniform across the diameter of the fiber. In other words, Sasaoka provides no indication that a portion of the fiber having a given cross-sectional area would have a different Raman gain coefficient of a different portion of the fiber having the same given cross-sectional area. Sasaoka discloses that the Raman gain coefficient G_R/A_{eff} of $0.005 \text{ (W}^*\text{m)}^{-1}$ is a minimum value, but greater values of the Raman gain coefficient would still be a function of area of the fiber as a whole, and not as a function of different portions of the fiber. Therefore, the disclosure of the Raman gain coefficient G_R/A_{eff} of $0.005 \text{ (W}^*\text{m)}^{-1}$ being a minimum value does not mean that it is not uniform across the diameter of the fiber, in contrast to the Examiner's assertion.

The Examiner also states that "Appellant has further argued that the G_R/A_{eff} value shows a static value for a given area, and that it is logically inconsistent that the value is uniform across the diameter of the fiber," (Examiner's Answer, page 10). Representative for Appellant respectfully submits that the Examiner has mischaracterized the statement by Representative for Appellant. Instead, Representative for Appellant respectfully stated that "[s]ince the Raman gain coefficient is a static value for 'a given area', as conceded by the Examiner, the Examiner's conclusion that it does not mean that the value is uniform across the diameter of the fiber is logically inconsistent," (Appeal Brief, page 14).

In addition, the Examiner concedes that Sasaoka teaches the G_R/A_{eff} value to be a function of area, not as a function of a specific location of the area (Examiner's Answer, page 10). However, the Examiner proceeds by stating that "[i]t is obvious that the G_R/A_{eff} value is a function of the area as it would follow the dopant profile," (Examiner's Answer, page 10). The Examiner has not made it clear as to what is meant by "the area" in such a statement, or how it is relevant to the asserted dopant profile of Sasaoka. Representative for Appellant believes that the

Examiner may be erroneously drawing a conclusion regarding a Raman gain coefficient profile of Sasoaka based on the Raman gain coefficient G_R/A_{eff} value.

Representative for Appellant recognizes that, for a given Raman gain coefficient G_R/A_{eff} value, as the effective cross-sectional area decreases, the Raman gain increases. Representative for Appellant thus believes that the Examiner may be asserting that radial dependence of a Raman gain profile, as recited in claim 1, and the cross-sectional area dependence of a Raman gain coefficient G_R/A_{eff} are equivalent. Representative for Appellant respectfully submits that such an assertion is incorrect. FIG. 2 of the Present Application demonstrates the Raman gain profile and the refractive index profile each as a function of the radius of the single mode core (Present Application, FIG. 2). Although effective area of a fiber can be derived from a radius, the Raman gain coefficient G_R/A_{eff} of $0.005 \text{ (W}^*\text{m)}^{-1}$, as disclosed by Sasoaka, does not result in a plot that resembles that of FIG. 2 of the Present Application. Specifically, the plot demonstrated in FIG. 2 of the Present Application demonstrates a Raman gain $G_R(r)$, which is a Raman gain G_R as a function of radius (Present Application, paragraph 19; FIG. 2). Instead, a static value of a Raman gain coefficient G_R/A_{eff} (e.g., 0.005) demonstrates that all portions of a fiber have the same Raman gain G_R for a given effective area of the fiber. Since FIG. 2 of the Present Application demonstrates a Raman gain G_R that is dependent on the radius of the fiber, the Raman gain G_R in the Present Application, as demonstrated in FIG. 2, is not the same for the given effective area of the fiber. Accordingly, the disclosure by Sasoaka of a Raman gain coefficient G_R/A_{eff} of $0.005 \text{ (W}^*\text{m)}^{-1}$ does not result in a radially dependent Raman gain profile, as demonstrated in FIG. 2 of the Present Application and as recited in claim 1.

The disclosure of U.S. Patent No. 6,363,087 to Rice ("Rice") further supports this conclusion. In the Appeal Brief, Representative for Appellant submitted the following comments:

Rice discloses a Raman gain of the system expressed by $(g_R * P_p)/A_p$, where g_R is the Raman gain coefficient, P_p is the pump beam power, and A_p is the cross-sectional area of the pump core (Rice, col. 3, ll. 46-48). In describing this equation, Rice discloses that this Raman gain is *uniformly distributed* at every point over the Raman pump core (Rice, col. 3, ll. 43-46; emphasis added). As the difference between the equation for Raman gain described in Rice for the system and the Raman gain

described in Sasaoka for the fiber is only a product of the pump power, as described in Rice, it is demonstrated that the Raman gain is expressed the same for the optical fiber in both references, and that such expression for Raman gain of the optical fibers is uniformly distributed. (Appeal Brief, page 15).

In response, the Examiner states that the reference by Representative for Appellant regarding Rice is moot as Rice is not relied on to teach this feature. Representative for Appellant respectfully submits that the reference to Rice is being offered by Representative for Appellant in direct support of the statement that the disclosure by Sasaoka of a Raman gain coefficient G_R/A_{eff} of $0.005 \text{ (W}^*\text{m)}^{-1}$ does not result in a radially dependent Raman gain profile, as demonstrated in FIG. 2 of the Present Application and as recited in claim 1. Representative for Appellant respectfully submits that it is highly appropriate to offer these statements regarding Rice, as the Federal Circuit has decided that a prior art reference must be considered in its entirety, *i.e.*, as a whole, including portions that would lead away from the claimed invention. *W.L. Gore & Associates, Inc. v. Garlock, Inc.*, 721 F.2d 1540, 220 USPQ 303 (Fed. Cir. 1983), *cert. denied*, 469 U.S. 851 (1984). Therefore, it is inappropriate for the Examiner to dismiss this disclosure by Rice, as both Rice and Sasaoka are to be considered in their entirety. Accordingly, Representative for Appellant again respectfully submits that the disclosure by Sasaoka of a Raman gain coefficient G_R/A_{eff} of $0.005 \text{ (W}^*\text{m)}^{-1}$ does not result in a radially dependent Raman gain profile based on the disclosure by Rice that a Raman gain is uniformly distributed across a given area at a given pump beam power.

Also regarding claim 1, the Examiner states that "Appellant has argued that the Sasaoka refractive index profile of fig. 1b is not consistent with a radially dependent dopant profile and the claimed Raman gain profile," (Examiner's Answer, page 11). Representative for Appellant respectfully submits that the Examiner has mischaracterized the argument presented by Representative for Appellant in the Appeal Brief. Specifically, Representative for Appellant respectfully submits that, in the Appeal Brief, Representative for Appellant argued against the assertion by the Examiner regarding "changes" to the doping profile of Sasaoka based on the use of the GeO_2 dopant (see Appeal Brief, pages 16-17). Representative for Appellant respectfully maintains the argument that there is no indication in Sasaoka or anywhere else that the doping of the fiber of Sasaoka with GeO_2 effects a "change" in the refractive index profile, as suggested by

the Examiner, and that there is no indication in the disclosure of Sasaoka that the refractive index profile demonstrated in FIG. 1B of Sasaoka results from radial doping.

In the Examiner's Answer, the Examiner states that "[t]he Appellant has argued that there is no motivation for combining the Sasaoka and Rice prior art pieces," and reiterates the provided motivation that was asserted in the Final Office Action dated August 21, 2007 (hereinafter "Final Office Action", Examiner's Answer, page 11). Representative for Appellant respectfully submits to having an awareness of the motivation that was asserted in the Final Office Action. However, Representative for Appellant respectfully disagrees with this motivation, and thus respectfully submits that it is improper motivation for one of ordinary skill in the art to combine the Sasoaka and Rice references to achieve the combination of elements of claim 1. Accordingly, Representative for Appellant respectfully maintains the arguments provided in the Appeal Brief regarding a lack of proper motivation for one of ordinary skill in the art to combine the Sasoaka and Rice references to achieve the combination of elements of claim 1 (see Appeal Brief, pages 18-21).

In the Examiner's Answer, the Examiner states that "[t]he Appellant has argued that it is non-obvious to incorporate a refractive index of a single mode fiber, as taught by Sasaoka, into a multimode fiber, as taught by Rice," (Examiner's Answer, page 11). The Examiner responds to the argument by stating that the point is moot "as the combination was made as Sasaoka in view of Rice, not Rice in view of Sasaoka," (Examiner's Answer, page 12). Representative for Appellant respectfully submits that such a response by the Examiner is irrelevant, and again refers to the Federal Circuit decision in *W.L. Gore & Associates* that prior art references must be considered in their entirety.

The Examiner proceeds by stating that "the combination of the multimode fiber properties of Rice were motivated to be used with the refractive index profile (dopant profile) of Sasaoka," (Examiner's Answer, page 12). Representative for Appellant respectfully maintains that it would not be obvious for one of ordinary skill to combine the Sasaoka and Rice references to achieve the combination of elements of claim 1 based on the fibers described by each of Sasaoka and Rice having single mode cores. Thus, Representative for Appellant respectfully submits that it is not apparent what, if any, effect could be achieved by incorporating the Raman

pump core taught by Rice into the optical fiber of Sasaoka, as suggested by the Examiner (see Appeal Brief, pages 19-21). Thus, Representative for Appellant's reference to *KSR v. Teleflex* is pertinent, in contrast to the Examiner's assertion (Examiner's Answer, page 12), as Representative for Appellant respectfully maintains that the Examiner still fails to provide some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness regarding claim 1 in view of Sasaoka and Rice. See *KSR Int'l Co. v. Teleflex Inc.*, 127 S. Ct. 1727, 1741 (2007), citing *In re Kahn*, 441 F.3d 977, 988 (CA Fed. 2006).

For all of these reasons, Representative for Appellant respectfully maintains that neither Sasaoka nor Rice, individually or in combination, make obvious claim 1. Accordingly, withdrawal of this rejection is respectfully requested.

With regard to claim 5, the Examiner "points out that claim 5 depends from claim 2, not from claim 1 as is stated on page 22 of the Appeal Brief," (Examiner's Answer, page 13). Representative for Appellant agrees, but claim 2 depends from claim 1. Therefore, claim 5 depends indirectly from claim 1.

In addition, the Examiner states that claim 5 "was interpreted as being met by the teachings of Sasaoka in that only the dopant profile is used to control both the refractive index and the Raman gain profile," and that "only the dopant profile is used to direct these two items it is believe to be a reasonable interpretation that the dopant profile is acting as an independent control," (Examiner's Answer, page 13). Representative for Appellant respectfully submits that the Examiner fails to appreciate the term "independent control" as recited in claim 5. Specifically, the Examiner fails to demonstrate how a single dopant, as described in Sasaoka, can control the refractive index profile and the Raman gain profile *independently* with respect to each other. In other words, Representative for Appellant agrees that the single dopant described in Sasaoka affects both the refractive index and the Raman gain of the associated fiber, but because it affects both, it is illogical that the refractive index and the Raman gain of the associated fiber can be controlled independently of each other with only the single dopant. Therefore, Representative for Appellant respectfully maintains that the combination of Sasaoka and Rice do not make obvious claim 5.

CONCLUSION

In view of the foregoing remarks, Applicant respectfully submits that the present application is in condition for allowance. Applicant respectfully requests reconsideration of this application and that the application be passed to issue.

Please charge any deficiency or credit any overpayment in the fees for this amendment to our Deposit Account No. 20-0090.

Respectfully submitted,

Date 16 June 2008

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